PATENT ABSTRACTS OF JAPAN

(11)Publication number : **08-135543**

(43)Date of publication of application : **28.05.1996**

(51)Int.Cl. F02M 69/00
F02M 37/10
F02M 55/02
F02M 55/02

(21)Application number : **06-277930**

(22)Date of filing : **11.11.1994**

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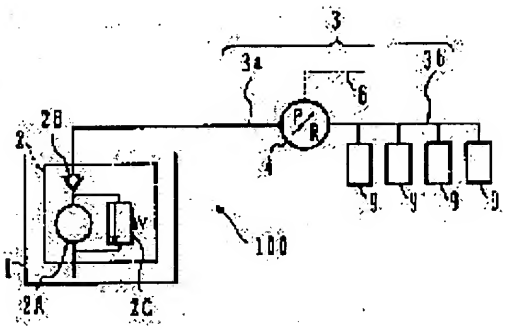
(54) FUEL SUPPLY DEVICE AND FUEL PRESSURE REGULATING VALVE

(57)Abstract:

PURPOSE: To dispense with a fuel return pipe and to reduce pressure fluctuation near a fuel injection valve by providing a fuel supply pipe with an inflow control type fuel pressure regulating valve for forcing fuel of the upstream side part to flow in the downstream side part to keep the downstream side pressure at a designated value when the pressure of the downstream side part is lowered than a designated value.



CONSTITUTION: A fuel supply device 100 comprises a pump device 2 including a tank 1, a pump 2A, a check valve 2B and a relief valve 2C, and a fuel injection valve 9 for injecting fuel introduced into a fuel supply pipe 3, wherein an inflow control type fuel pressure regulating valve 4 is disposed in the midway of the fuel supply pipe 3. The fuel pressure regulating valve 4 has a diaphragm for dividing the interior of a casing into a reference pressure chamber and a pressure regulating chamber, and a function of forcing fuel of an upstream side supply pipe 3a to flow in a downstream side supply pipe 3b to make the pressure of the downstream side supply pipe 3b larger than the reference pressure by designated differential pressure when a differential pressure between the pressure of the downstream side supply pipe 3b of the fuel supply pipe 3 and the reference pressure introduced through a reference pressure introducing pipe 6 becomes smaller than designated

* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] Fuel pump equipment equipped with a discharge-pressure maintenance means to hold the fuel pump which pressurizes and carries out the regurgitation of the fuel in the fuel tank where a fuel is stored, and this fuel tank, and the discharge pressure of this fuel pump to the 1st predetermined value, At least one fuel injection valve which injects the fuel to which it connected with the downstream end of the fuel feeding pipe connected to said fuel pump equipment, and this fuel feeding pipe, respectively, and the upstream end was led from said fuel feeding pipe within [engine] inhalation of air, In the fuel supply system which has reference ******** which draws the reference pressure near the injection section of said fuel injection valve, and the fuel-pressure regulator valve which is connected to this reference ******** and adjusts the fuel pressure in said fuel feeding pipe While said fuel-pressure regulator valve is prepared on said fuel feeding pipe and holding the pressure of an upstream part from this fuel-pressure regulator valve to the 1st predetermined value among these fuel feeding pipes The fuel supply system with which the pressure of a downstream part is characterized by making the fuel of said upstream part flow into said downstream part when it becomes smaller than the 2nd predetermined value smaller than the 1st predetermined value, and holding the pressure of this downstream part to said 2nd predetermined value among [regulator valve / this / fuel-pressure] these fuel feeding pipes.
[Claim 2] Said fuel-pressure regulator valve is a fuel supply system characterized by holding so that the fuel of an upstream part may be made to flow into a downstream part and only said ****** to predetermined differential pressure may become large about the pressure of said downstream part, when the differential pressure of the pressure of a downstream part and said ****** becomes smaller than predetermined differential pressure from this fuel-pressure regulator valve among these fuel feeding pipes in a fuel supply system according to claim 1.
[Claim 3] It is the fuel supply system characterized by having further the check valve in which said fuel pump equipment permits only the flow from said fuel pump to said direction of a fuel feeding pipe in a fuel supply system according to claim 1.
[Claim 4] In a fuel supply system according to claim 1 said fuel-pressure regulator valve It is prepared so that casing and the interior of casing may be classified into a ****** room and a pressure regulation room, and it responds to the size of the pressure of said reference ******, and the pressure of said pressure regulation interior of a room. Deformable diaphram, Reference pressure-welding **** to which it is fixed to said ****** room side of said casing, and said reference ******** is connected, The pressure regulation fuel delivery where it is fixed to said pressure regulation room side of said casing, and a downstream part is connected from this fuel-pressure regulator valve among said fuel feeding pipes, The supply fuel end connection to which it is fixed to the pressure regulation room side of said casing, and an upstream part is connected from this fuel-pressure regulator valve among said fuel feeding pipes, The 1st hole which is formed in this supply fuel end connection, and opens this interior of a supply fuel end connection, and the exterior for free passage, It is arranged in said pressure regulation interior of a room, and deformation of said diaphram is embraced. A movable bulb movable in the deformation direction of this diaphram, The fuel supply system characterized by having the 2nd hole

which will open said the 1st hole and said pressure regulation room for free passage if it is formed in this movable bulb and the differential pressure of the pressure of said pressure regulation interior of a room and the pressure of said reference ****** becomes small from said predetermined differential pressure.

[Claim 5] It is the fuel supply system characterized by having the relief valve connected by said discharge-pressure maintenance means branching from the discharge-side duct of said fuel pump in a fuel supply system according to claim 1.

[Claim 6] A pressure detection means to output the detecting signal which detects the pressure of an upstream part and corresponds from this fuel-pressure regulator valve among said fuel feeding pipes in a fuel supply system according to claim 1, It has further a pump-control means to control the drive of this fuel pump to become the 3rd predetermined value which has the discharge pressure of said fuel pump in the larger range smaller than said 1st predetermined value and than said 2nd predetermined value according to said detecting signal. Said fuel-pressure regulator valve is a fuel supply system characterized by holding the pressure of an upstream part from this fuel-pressure regulator valve among said fuel feeding pipes at said 3rd predetermined value.

[Claim 7] In the fuel-pressure regulator valve which adjusts the fuel pressure in the fuel feeding pipe which is connected to reference ******** which draws the reference pressure near the injection section of the fuel injection valve which injects a fuel within [engine] inhalation of air, and leads a fuel to said fuel injection valve It is prepared so that casing and the interior of casing may be classified into a ****** room and a pressure regulation room, and it responds to the size of the pressure of said reference ******, and the pressure of said pressure regulation interior of a room. Deformable diaphram, Reference pressure-welding **** to which it is fixed to said ****** room side of said casing, and said reference ******** is connected, The pressure regulation fuel delivery where it is fixed to said pressure regulation room side of said casing, and a downstream part is connected from this fuel-pressure regulator valve among said fuel feeding pipes, The supply fuel end connection to which it is fixed to the pressure regulation room side of said casing, and an upstream part is connected from this fuel-pressure regulator valve among said fuel feeding pipes, The 1st hole which is formed in this supply fuel end connection, and opens this interior of a supply fuel end connection, and the exterior for free passage, It is arranged in said pressure regulation interior of a room, and deformation of said diaphram is embraced. A movable bulb movable in the deformation direction of this diaphram, The fuel pressure regulating valve characterized by having the 2nd hole which will open said the 1st hole and said pressure regulation room for free passage if it is formed in this movable bulb and the differential pressure of the pressure of said pressure regulation interior of a room and the pressure of said reference ****** becomes small from the 1st predetermined differential pressure.

[Claim 8] Said movable bulb is a fuel pressure regulating valve characterized by preparing a part of inner circumference [at least] in contact with the periphery of said supply fuel end connection in a fuel pressure regulating valve according to claim 7, and sliding on the shaft orientations of this supply fuel end connection according to deformation of said diaphram.

[Claim 9] The fuel pressure regulating valve characterized by having the spring with which it is arranged at said reference ******, and an end energizes this diaphram toward said pressure regulation fuel delivery side in a fuel pressure regulating valve according to claim 7 in contact with said diaphram by the energization force of magnitude equal to said 1st predetermined differential pressure.

[Claim 10] It is the fuel pressure regulating valve characterized by having the opening part which will open said the 1st hole and said pressure regulation room for free passage if the differential pressure of the pressure of said pressure regulation interior of a room [bulb / said / movable] and the pressure of said reference ****** becomes large in a fuel pressure regulating valve according to claim 7 from the 2nd bigger predetermined differential pressure than said 1st predetermined differential pressure.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the fuel supply system equipped with the fuel-pressure regulator valve which adjusts the pressure of a fuel to the combustion chamber of an automobile engine especially with respect to the fuel supply system which supplies a fuel, and this fuel-pressure regulator valve.
[0002]
[Description of the Prior Art] Generally in the conventional automotive fuel feeder, the fuel pressure is adjusted using an overflow control form fuel-pressure regulator valve. As a well-known technique about such a fuel supply system, there are the following, for example.
[0003] ** In the well-known technique of ******53-40105********, the fuel which came out of the pumping plant formed into the tank is led to the overflow control form fuel-pressure regulator valve connected to the serial through the fuel feeding pipe. The pressure of for example, the intake manifold collector section is led to the fuel-pressure regulator valve through reference ********, based on this pressure, it is controlled so that the differential pressure of the injection section pressure of a fuel injection valve and fuel pressure keeps it constant, and the overflow fuel for a surplus is returned to a tank through return tubing.
[0004] ** An overflow control form fuel-pressure regulator valve can be arranged near the tank while branching from a fuel feeding pipe and connecting with juxtaposition, and the well-known technique of ******47-13558******** omits substantially return tubing for returning an overflow fuel to a tank by this, reduces a tooth space and cost, and can constitute what is called a return loess method.
[0005] Moreover, there are the following as a well-known technique in which do not prepare a fuel-pressure regulator valve but other means adjust fuel pressure.
[0006] ** When the fuel control system which branched from the fuel feeding pipe and was connected to juxtaposition controls a halt and drive of pumping plant so that fuel pressure serves as a predetermined value, the well-known technique of the Patent Publication Heisei No. 500764 [two to] ****** omits return tubing, and realizes a return loess method.
[0007]
[Problem(s) to be Solved by the Invention] However, the following technical problems exist in the above-mentioned well-known technique. That is, in well-known technical **, since a fuel-pressure regulator valve will be arranged at the car-body anterior part in which an engine is carried and the tank was in the point empty vehicle object posterior part of safety reservation on the other hand, it was difficult for return tubing to which both are connected to make it huge, and to attain space-saving-izing and ** cost-ization.
[0008] Moreover, in well-known technical **, since pumping plant and a fuel-pressure regulator valve approach comparatively and are arranged, the die length of return tubing becomes very short (lost substantially), a return loess method can be realized, but since the die length becomes long in preparing reference ******** by one side, the effectiveness of return tubing shortening and simplification is

reduced. Moreover, since the transfer lag of engine operational status arises, that the die length of reference ******** becomes long worsens operability and an exhaust gas condition at the time of operational status change. Furthermore, since the distance of a fuel-pressure regulator valve and a fuel injection valve becomes long by attaching a fuel-pressure regulator valve near the tank, fuel pressure fluctuation near the fuel injection valve becomes large, and highly precise fuel supply control becomes impossible. Moreover, also at the time of the temperature rise after an engine shutdown, since the injection-valve opening pressure of overflow is fixed, air bubbles are generated from a fuel and engine restart nature is worsened.

[0009] Furthermore, in well-known technical ** and **, pumping plant is always a whole-quantity discharge condition, and is a configuration through which the part which deducted the fuel flow injected from the fuel injection valve among the fuel flow sent out from this pumping plant circulates to a tank as an overflow flow rate from a fuel-pressure regulator valve. While it followed, for example, the flow rate loss of a fuel arose at the time of low r.p.m. operation, useless operation of a pump was not able to be controlled and reduction of consumption power was not able to be aimed at. Moreover, since the above-mentioned overflow flow rate becomes very large, for example at the time of idle operation and a tank circulating load increases, the fuel temperature rise in a tank may be caused. Therefore, the yield of a fuel vapor increases by this and the burden to the canister equipment for a fuel vapor cure becomes large. Moreover, although there is also the approach of presuming from the control signal given to a fuel injection valve, controlling the supply voltage to the motor of pumping plant, and controlling the amount of sending out from pumping plant by this in order to lessen this fuel circulating load and to cancel a flow rate loss, the precision in control is inadequate. For this reason, it became the problem that a control unit became expensive.

[0010] Furthermore, in well-known technical **, are a fuel control system, and when fuel pressure becomes higher than the 1st pressure, a pump is suspended. Since control which drives a pump is performed when fuel pressure becomes lower than the 2nd pressure smaller than the 1st pressure, since it always changes, highly precise fuel pressure control cannot do between the 1st pressure and the 2nd pressure, and fuel pressure lacks in the stability of control.

[0011] The 1st purpose of this invention is offering the fuel-pressure regulator valve used for the fuel supply system of the return loess method in which highly precise and stable fuel pressure control is possible, and this, controlling gassing without lengthening the die length of reference ********, and distance of a fuel-pressure regulator valve and a fuel injection valve.

[0012] The 2nd purpose of this invention is offering the fuel supply system which can aim at cheaply flow rate loss of a pump, and reduction of consumption power.

[0013]

[Means for Solving the Problem] The fuel tank where a fuel is stored according to this invention in order to attain the 1st purpose of the above, Fuel pump equipment equipped with a discharge-pressure maintenance means to restrict the fuel pump which pressurizes and carries out the regurgitation of the fuel in this fuel tank, and the discharge pressure of this fuel pump to the 1st predetermined value, At least one fuel injection valve which injects the fuel to which it connected with the downstream end of the fuel feeding pipe connected to said fuel pump equipment, and this fuel feeding pipe, respectively, and the upstream end was led from said fuel feeding pipe within [engine] inhalation of air, In the fuel supply system which has reference ******** which draws the reference pressure near the injection section of said fuel injection valve, and the fuel-pressure regulator valve which is connected to this reference ******** and adjusts the fuel pressure in said fuel feeding pipe While said fuel-pressure regulator valve is prepared on said fuel feeding pipe and holding the pressure of an upstream part from this fuel-pressure regulator valve below to the 1st predetermined value among these fuel feeding pipes The fuel supply system with which the pressure of a downstream part is characterized by making the fuel of said upstream part flow into said downstream part when it becomes smaller than the 2nd predetermined value smaller than the 1st predetermined value, and holding the pressure of this downstream part to said 2nd predetermined value is offered from this fuel-pressure regulator valve among these fuel feeding pipes.

[0014] Preferably, in said fuel supply system, said fuel-pressure regulator valve makes the fuel of an upstream part flow into a downstream part, if the differential pressure of the pressure of a downstream part and said ****** becomes smaller than predetermined differential pressure from this fuel-pressure regulator valve among these fuel feeding pipes, and the fuel supply system characterized by holding the pressure of said downstream part so that only said ****** to predetermined differential pressure may become large is offered.
[0015] Moreover, in said fuel supply system, the fuel supply system characterized by said fuel pump equipment having further the check valve which permits only the flow from said fuel pump to said direction of a fuel feeding pipe is offered preferably.
[0016] It sets to said fuel supply system still more preferably. Said fuel-pressure regulator valve It is prepared so that casing and the interior of casing may be classified into a ****** room and a pressure regulation room, and it responds to the size of the pressure of said reference ******, and the pressure of said pressure regulation interior of a room. Deformable diaphram, Reference pressure-welding **** to which it is fixed to said ****** room side of said casing, and said reference ******** is connected, The pressure regulation fuel delivery where it is fixed to said pressure regulation room side of said casing, and a downstream part is connected from this fuel-pressure regulator valve among said fuel feeding pipes, The supply fuel end connection to which it is fixed to the pressure regulation room side of said casing, and an upstream part is connected from this fuel-pressure regulator valve among said fuel feeding pipes, The 1st hole which is formed in this supply fuel end connection, and opens this interior of a supply fuel end connection, and the exterior for free passage, It is arranged in said pressure regulation interior of a room, and deformation of said diaphram is embraced. A movable bulb movable in the deformation direction of this diaphram, If it is formed in this movable bulb and the differential pressure of the pressure of said pressure regulation interior of a room and the pressure of said reference ****** becomes small from said predetermined differential pressure, the fuel supply system characterized by having the 2nd hole which opens said the 1st hole and said pressure regulation room for free passage will be offered.
[0017] Moreover, in said fuel supply system, the fuel supply system characterized by equipping said discharge-pressure maintenance means with the relief valve connected by branching from the discharge-side duct of said fuel pump is offered preferably.
[0018] In order to attain the 1st and 2nd purposes of the above furthermore, preferably A pressure detection means to output the detecting signal which detects the pressure of an upstream part and corresponds from this fuel-pressure regulator valve among said fuel feeding pipes in said fuel supply system, The fuel supply system characterized by having further a pump-control means to control the drive of this fuel pump to become the 3rd predetermined value which has the pressure of said upstream part in the larger range smaller than said 1st predetermined value and than said 2nd predetermined value according to said detecting signal is offered.
[0019] Moreover, in order to attain the 1st purpose of the above, according to this invention, it connects with reference ******** which draws the reference pressure near the injection section of the fuel injection valve which injects a fuel within [engine] inhalation of air. In the fuel-pressure regulator valve which adjusts the fuel pressure in the fuel feeding pipe which leads a fuel to said fuel injection valve It is prepared so that casing and the interior of casing may be classified into a ****** room and a pressure regulation room, and it responds to the size of the pressure of said reference ******, and the pressure of said pressure regulation interior of a room. Deformable diaphram, Reference pressure-welding **** to which it is fixed to said ****** room side of said casing, and said reference ******** is connected, The pressure regulation fuel delivery where it is fixed to said pressure regulation room side of said casing, and a downstream part is connected from this fuel-pressure regulator valve among said fuel feeding pipes, The supply fuel end connection to which it is fixed to the pressure regulation room side of said casing, and an upstream part is connected from this fuel-pressure regulator valve among said fuel feeding pipes, The 1st hole which is formed in this supply fuel end connection, and opens this interior of a supply fuel end connection, and the exterior for free passage, It is arranged in said pressure regulation interior of a room, and deformation of said diaphram is embraced. A movable bulb movable

in the deformation direction of this diaphram, If it is formed in this movable bulb and the differential pressure of the pressure of said pressure regulation interior of a room and the pressure of said reference ****** becomes small from the 1st predetermined differential pressure, the fuel pressure regulating valve characterized by having the 2nd hole which opens said the 1st hole and said pressure regulation room for free passage will be offered.

[0020] Preferably, in said fuel pressure regulating valve, the fuel pressure regulating valve characterized by preparing a part of inner circumference [at least] in contact with the periphery of said supply fuel end connection, and sliding on said movable bulb at the shaft orientations of this supply fuel end connection according to deformation of said diaphram is offered.

[0021] Moreover, preferably, in said fuel pressure regulating valve, it is arranged at said reference ****** and the fuel pressure regulating valve characterized by having the spring with which an end energizes this diaphram toward said pressure regulation fuel delivery side in contact with said diaphram by the energization force of magnitude equal to said 1st predetermined differential pressure is offered.

[0022] In said fuel pressure regulating valve, the fuel pressure regulating valve characterized by said movable bulb having the opening part which will open said the 1st hole and said pressure regulation room for free passage if the differential pressure of the pressure of said pressure regulation interior of a room and the pressure of said reference ****** becomes small from the 2nd bigger predetermined differential pressure than said 1st predetermined differential pressure is offered still more preferably.

[0023]

[Function] In this invention constituted as mentioned above, while being breathed out with the fuel pump with which fuel pump equipment was equipped, the fuel with which the pressure was held with the discharge-pressure maintenance means at the 1st predetermined value is led to a fuel injection valve through a fuel feeding pipe, and this fuel is injected by the fuel injection valve within [engine] inhalation of air. And the fuel pressure in a fuel feeding pipe is adjusted by the fuel-pressure regulator valve to which the reference pressure near the fuel injection valve is led through reference ********. If this fuel-pressure regulator valve is prepared on a fuel feeding pipe and the pressure of a downstream part becomes smaller than the 2nd predetermined value at this time Since fuel return tubing like the conventional overflow control form fuel-pressure regulator valve becomes completely unnecessary by being the inflow control form fuel-pressure regulator valve which the fuel of an upstream part is made to flow into a downstream part, and holds a downstream pressure to the 2nd predetermined value Though it is a return loess method, a fuel-pressure regulator valve can be arranged near the fuel injection valve, and reference ******** can be shortened. Moreover, even when a fuel-pressure regulator valve is an inflow control form fuel-pressure regulator valve which makes the fuel of an upstream part flow into a downstream part when the pressure of a downstream part becomes small and the fuel of the downstream becomes an elevated temperature by the preheating after engine operation termination, a fuel-pressure regulator valve opens and is not open for free passage, and maintains the downstream to high pressure. That is, since a fuel-pressure regulator valve opens easily like before and the inside of a fuel feeding pipe does not serve as low voltage, generating of the air bubbles by the temperature rise is controlled. Furthermore, since the pressure of the downstream part of a fuel-pressure regulator valve is uniquely determined as the 2nd predetermined value, a pressure is not changed like before which performs a drive and a halt of a pump with a fuel control system, and highly precise and stable fuel pressure control can be performed.

[0024] Moreover, a fuel-pressure regulator valve can realize the function in which the differential pressure of the pressure of a downstream part and ****** makes regularity phase counter pressure of supply fuel pressure and the fuel injection valve injection section from a fuel-pressure regulator valve by making the fuel of an upstream part flow into a downstream part, and holding the pressure of a downstream part from ****** so that only predetermined differential pressure may become large if it becomes smaller than predetermined differential pressure, among fuel feeding pipes. Furthermore, the fuel of the downstream serves as an elevated temperature by the preheating after engine operation termination by preparing further the check valve which permits only the flow from a fuel pump to the direction of a fuel feeding pipe to fuel pump equipment, and while a fuel-pressure regulator valve does

not open but the downstream is maintained to high pressure, since the back flow to the direction of a fuel pump is prevented and serves as high pressure, in the upstream, the inside of tubing does not serve as low voltage like before by the check valve. That is, generating of the air bubbles also according [the upstream] to a temperature rise is controlled. A fuel-pressure regulator valve is prepared so that casing and the interior of casing may be classified into a ****** room and a pressure regulation room, and it responds to the size of the pressure of reference ******, and the pressure of the pressure regulation interior of a room. Moreover, deformable diaphram, Reference pressure-welding **** to which it is fixed to the ****** room side of casing, and reference ******** is connected, The pressure regulation fuel delivery where it is fixed to the pressure regulation room side of casing, and a downstream part is connected from a fuel-pressure regulator valve among fuel feeding pipes, The supply fuel end connection to which it is fixed to the pressure regulation room side of casing, and an upstream part is connected from a fuel-pressure regulator valve among fuel feeding pipes, The 1st hole which is formed in this supply fuel end connection, and opens the interior of a supply fuel end connection, and the exterior for free passage, When it is arranged in the pressure regulation interior of a room, and is formed in the deformation direction of diaphram at a movable movable bulb and this movable bulb according to deformation of diaphram and the differential pressure of the pressure of the pressure regulation interior of a room and the pressure of reference ****** becomes small from predetermined differential pressure, it has the 2nd hole which opens the 1st hole and pressure regulation room for free passage. If the pressure in the downstream part of a fuel feeding pipe becomes small and the differential pressure of the pressure of the pressure regulation interior of a room and the pressure of reference ****** becomes small by this, diaphram will deform into a pressure regulation room side, and a movable bulb will move to a pressure regulation room side according to this. And if the differential pressure of the pressure of further the pressure regulation interior of a room and the pressure of reference ****** becomes small and this value becomes small from the 1st predetermined differential pressure Since a movable bulb furthermore moves to a pressure regulation room side and the 1st hole and pressure regulation room of a supply fuel end connection are open for free passage through the 2nd hole of a movable bulb Through the 1st hole and 2nd hole, the fuel of the upstream part of a fuel feeding pipe can be made to be able to flow into a downstream part, and from ******, the pressure of a downstream part can be held so that only predetermined differential pressure may become small. Furthermore, a discharge-pressure maintenance means can realize a means to hold a pump discharge pressure to the 1st predetermined value, by having the relief valve connected by branching from the discharge-side duct of a fuel pump. Moreover, it has a pressure detection means to output the detecting signal which detects the pressure of an upstream part from a fuel-pressure regulator valve, and corresponds, and a pump-control means to control the drive of a fuel pump to become the 3rd predetermined value which has the pressure of an upstream part in the larger range smaller than the 1st predetermined value and than the 2nd predetermined value according to a detecting signal, among fuel feeding pipes. Since the downstream part of a fuel feeding pipe is maintained at the 3rd predetermined value with it by the 2nd predetermined value at this time, according to the size of a need fuel flow to a fuel injection valve, the drive of a fuel pump will be automatically controlled by the pump-control means. [than the 2nd predetermined value] [an upstream part smaller than the 1st predetermined value and] [bigger] Namely, although a lot of fuel flow is needed for a fuel injection valve at the time of high-speed operation, the fuel of a downstream part is quickly supplied to a fuel injection valve and the pressure of a downstream part tends to fall quickly Although a fuel is supplied to a downstream part from an upstream part by ******, and the pressure of a downstream part is maintained by the 2nd predetermined value and the pressure of an upstream part tends to fall quickly by this, that of a fuel-pressure regulator valve A fuel pump is controlled according to the rapid fall, it drives by high rotation, the pressure drop of an upstream part is prevented, and it maintains to the 3rd predetermined value. On the contrary, since a fuel flow required for a fuel injection valve is little at the time of low r.p.m. operation, it is sufficient for it, and the fuel of a downstream part is seldom supplied to a fuel injection valve but the pressure of a downstream part seldom falls, a fuel is seldom supplied to a downstream part from an upstream part, but the pressure of an upstream part tends to fall slowly. Therefore, a fuel pump will be controlled according to this slow

fall, and it will drive by low rotation. Thus, highly precise feedback control according to a need fuel flow and a pressure can be performed easily. That is, the differential pressure for flowing into a larger part downstream part than the 2nd predetermined value is securable by making the 3rd predetermined value at this time larger than the 2nd predetermined value. moreover, if the 3rd predetermined value is made larger than the 1st predetermined value, from it being held at the predetermined value of a basis 1st that the pressure of a fuel feeding pipe is also with a pump discharge-pressure maintenance means No matter what drive a pump may carry out, it cannot control, without resulting in the 3rd predetermined value, and whenever it makes it equal to the 1st predetermined value, the 3rd predetermined value will be reached, and there is no semantics to control. However, in this invention, by setting up the 3rd predetermined value smaller than the 1st predetermined value, the above-mentioned control can be performed effectively and reduction of a part with the 3rd predetermined value smaller than the 1st predetermined value, a pump flow rate loss, and pump consumption power can be aimed at.
[0025] Furthermore, in the fuel pressure regulating valve of this invention, by preparing a part of inner circumference [at least] in contact with the periphery of a supply fuel end connection, and sliding on the shaft orientations of a supply fuel end connection according to deformation of diaphram, a movable bulb is arranged in the pressure regulation interior of a room, and can realize a movable configuration in the deformation direction of diaphram. Moreover, it is arranged at reference ****** and a means to give the 1st predetermined differential pressure can be realized by having the spring with which an end energizes diaphram toward a pressure regulation fuel delivery side in contact with diaphram by the energization force of magnitude equal to the 1st predetermined differential pressure. The differential pressure of the pressure of the pressure regulation interior of a room and the pressure of reference ****** a movable bulb furthermore, by having the opening part which will open the 1st hole and pressure regulation room for free passage if it becomes smaller than the 2nd bigger predetermined differential pressure than the 1st predetermined differential pressure If a fuel temperature rises by the preheating after engine operation termination and the pressure of the downstream becomes the 2nd predetermined differential pressure, since a pressure regulation room and an upper part will be open for free passage through the 1st hole and opening part and the fuel of the downstream will flow into the upstream, the overpressure rise of the pressure regulation interior of a room can be prevented.
[0026]
[Example] Hereafter, drawing 1 - drawing 6 explain the example of this invention. Drawing 1 - drawing 4 explain the 1st example of this invention. This example is an example about a fuel supply system. The conceptual diagram showing the whole fuel supply system configuration by this example is shown in drawing 1 . In drawing 1 the fuel supply system 100 of this example Usually, the tank 1 by which it is prepared in the posterior part of an automobile for safety reservation, and a fuel is stored, Pump 2A which drives by the motor which is not illustrated, carries out suction pressurization and carries out the regurgitation of the fuel in a tank 1, Check-valve 2B which prevents the back flow of the fuel which connected with pump 2A and a serial and was breathed out, And the pumping plant 2 equipped with relief-valve 2C connected by branching from a discharge-pressure maintenance means, for example, the discharge-side duct of pump 2a, to hold the discharge pressure of pump 2A to the 1st predetermined value (after-mentioned), At least one injected within [of the engine which does not illustrate the fuel to which it connected with the downstream end of the fuel feeding pipe 3 connected to pumping plant 2, and this fuel feeding pipe 3, respectively, and the upstream end was led from the fuel feeding pipe 3] inhalation of air Reference ******** 6 which draws the reference pressure near the injection section of four fuel injection valves 9 and fuel injection valves 9, for example, the pressure of the intake manifold collector section which is not illustrated, in the illustration example, While being prepared on a fuel feeding pipe 3, it connects with reference ******** 6, and it has the fuel-pressure regulator valve 4 which adjusts the fuel pressure in a fuel feeding pipe 3.
[0027] It connects with pump 2A and juxtaposition, relief-valve 2C opens an internal path, when too much rise of a supply pressure arises, it misses a fuel on a tank 1, and maintains a pressure at the 1st predetermined value. The fuel injection valve 9 is attached in the intake manifold section of an engine inlet pipe, the valve-opening control signal from the electronic control unit which is not illustrated is

added, and the fuel oil consumption injected by the engine from a fuel injection valve 9 with this control signal is determined.

[0028] As the fuel-pressure regulator valve 4 adjusts the fuel pressure in the fuel feeding pipe 3 which is connected to reference ******** 6 and leads a fuel to a fuel injection valve 9 and is shown in drawing 5 mentioned later The diaphram 36 which classifies the casing 42 interior into the ****** room 51 and the pressure regulation room 52, Reference pressure-welding **** 44 to which reference ******** 6 is connected, and the pressure regulation fuel delivery 46 where downstream supply pipe 3b is connected from the fuel-pressure regulator valve 4 among fuel feeding pipes 3, The supply fuel end connection 22 to which upstream supply pipe 3a is connected from the fuel-pressure regulator valve 4 among fuel feeding pipes 3, The side hole 23 which opens the longitudinal hole 25 and the periphery slot 24 of the supply fuel end-connection 22 interior for free passage, Deformation of diaphram 36 is embraced. The movable bulb 26 movable in the deformation direction (the illustration vertical direction) of diaphram 36, It has the side hole 30 formed in this movable bulb 26, and the main spring 41 to which an end energizes diaphram 36 toward a pressure regulation fuel delivery side in contact with diaphram 36. If the differential pressure of the pressure of downstream supply pipe 3b of a fuel feeding pipe 3 and ****** drawn through reference ******** 6 becomes smaller than predetermined differential pressure by such configuration Make the fuel of upstream supply pipe 3a flow into downstream supply pipe 3b, and from ******, while holding only predetermined differential pressure so that it may become large, the pressure of downstream supply pipe 3b It has the function to hold the pressure of upstream supply pipe 3a of a fuel feeding pipe 3 to the 1st predetermined value beforehand set up by relief-valve 2C. In addition, the 1st predetermined value at this time is beforehand set up so that it may become always larger than the pressure of downstream supply pipe 3b.

[0029] Next, an operation of the fuel supply system 100 by this example constituted as mentioned above is explained. The fuel supply system 150 by the 1st example of a comparison of this example is shown in drawing 2 . This example of a comparison is an example of a comparison of the conventional fuel supply system which is not a return loess method. The same sign is given to a member equivalent to the fuel supply system 100 of this example. In drawing 2 , the main points that the fuel supply system 150 of this example of a comparison differs from the fuel supply system 100 of this example The fuel-pressure regulator valve 5 according to for example, an operation of ****** which the pressure regulation spring and reference ******** 6 which are the fuel-pressure regulator valve of an overflow control form as shown in JP,5-321792,A etc., and were prepared in the interior, and which are not illustrated drew It has the function to open an internal valve by pressure to which the differential pressure of the fuel pressure led to a fuel injection valve 9 and the pressure in the injection section of a fuel injection valve 9 becomes fixed, The overflow fuels for a surplus from this fuel-pressure regulator valve 5 are being returned to a tank 1 through the fuel return tubing 8, and prepared in the branch line 7 to which this fuel-pressure regulator valve's 5 is not on a fuel feeding pipe 3, and branched from the fuel feeding pipe 3. Other configurations are the same as that of the fuel supply system 100 of the 1st example almost.

[0030] In the above configuration, while the fuel-pressure regulator valve 5 had been arranged at the car-body anterior part in which an engine is carried, since it was usually in the point empty vehicle object posterior part of safety reservation, the tank 1 was difficult for the fuel return tubing 8 to which both are connected to make it huge, and to attain space-saving-izing and ** cost-ization.

[0031] On the other hand, in the fuel supply system 100 of this example, the fuel-pressure regulator valve 4 is formed on a fuel feeding pipe 3, and if the pressure of downstream supply pipe 3b becomes small, fuel return tubing like the fuel-pressure regulator valve 5 of the above-mentioned conventional overflow control form will become completely unnecessary by being the inflow control form fuel-pressure regulator valve which makes the fuel of upstream supply pipe 3a flow into downstream supply pipe 3b. Therefore, space-saving-izing and ** cost-ization can be attained. The fuel.supply system 170 by the 2nd example of a comparison of this example is shown in drawing 3 . This example of a comparison is the conventional fuel supply system which has adopted the return loess method. The same sign is given to a member equivalent to the fuel supply system 100 of this example, and the fuel supply

system 150 of the 1st example of a comparison. In drawing 3 , the branch line 7 of the main points that the fuel supply system 170 of this example of a comparison differs from the fuel supply system 150 of the example of a comparison of the above 1st in which the fuel-pressure regulator valve 5 of an overflow control form is formed is the thing of pumping plant 2 which it has branched from the fuel feeding pipe 3 in near comparatively, and the die length of the fuel return tubing 8 is very short by this. Other configurations are the same as that of the fuel supply system 150 of the 1st example of a comparison almost.

[0032] In the above configuration, although the die length of the fuel return tubing 8 becomes very short (lost substantially) and the so-called return loess method can be realized by pumping plant 2 and the fuel-pressure regulator valve 5 approaching comparatively, and arranging them, since the die length of reference ******** 6 becomes long by one side, the effectiveness of shortening and simplification of the fuel return tubing 8 is reduced. Moreover, since the transfer lag of engine operational status arises, that the die length of reference ******** 6 becomes long worsens operability and an exhaust gas condition at the time of operational status change. Furthermore, since the distance of the fuel-pressure regulator valve 5 and a fuel injection valve 9 becomes long by attaching the fuel-pressure regulator valve 5 in about one tank, the fuel pressure fluctuation by about nine fuel injection valve becomes large, and highly precise fuel supply control becomes impossible. Moreover, engine heat is received, it is cooled by the fuel to pass, the engine cooling water which flows the interior of a manifold, the cooling wind, etc. at the time of operation, and the fuel injection valve 9 is maintained at about 50 degrees C and comparatively low temperature. However, although it is based also on operational status since all the above-mentioned cooling effects of after an engine shutdown are lost and the heat of a hotter exhaust air part is transmitted, it is after after [an engine shutdown] 10 minutes -, and 15-minute progress, and about nine-fuel injection valve temperature may exceed 100 degrees C. In such a condition, the fuel in a fuel feeding pipe 3 tends to carry out temperature up expansion, and a pressure also tends to rise. Since the fuel-pressure regulator valve 5 will open easily and overflow will be started here if the pressure in a fuel feeding pipe 3 exceeds the value of atmospheric pressure+1 constant differential pressure, since the reference pressure at the time of an engine shutdown is atmospheric pressure although the fuel-pressure regulator valve 5 opens so that differential pressure of the pressure in a fuel feeding pipe 3 and the reference pressure drawn from the reference ****** piping 6 may be made into a certain fixed differential pressure, and overflow control is performed, the rise of fuel pressure does not take place. Therefore, the air bubbles of a fuel are generated in a fuel feeding pipe 3, and the problem which worsens engine restart nature arises.

[0033] Moreover, since it is an overflow control form, while pumping plant 2 is always mostly maintained by the whole-quantity discharge condition, the fuel-pressure regulator valve 5 Since it is the configuration through which the part which deducted the fuel flow injected from the fuel injection valve 9 among the fuel flow sent out from pumping plant 2 circulates to a tank 1 as an overflow flow rate For example, since an overflow flow rate arises in large quantities at the time of low r.p.m. operation and the circulating load of the fuel in a tank 1 is made [many], the fuel temperature rise in a tank 1 is caused, and the problem of enlarging the burden to the canister equipment for a fuel vapor cure which makes [many] the yield of a fuel vapor and does not illustrate it is generated. Here, in order to lessen this charge circulating load of tank 1 internal combustion according to this, it is possible to control the amount of sending out from pumping plant 2, but since the fuel pressure in a fuel feeding pipe 3 becomes almost equal to the overflow pressure of the fuel-pressure regulator valve 5, there is no room to control this alternatively. Or although there is also the approach of presuming from the control signal given to a fuel injection valve 9, for example, and controlling the supply voltage to the motor for pumps which is not illustrated, it does not become control of an in this case sufficiently high precision.

[0034] On the other hand, it sets to the fuel supply system 100 of this example. By being the inflow control form fuel-pressure regulator valve which makes the fuel of upstream supply pipe 3a flow into downstream supply pipe 3b when the fuel-pressure regulator valve 4 is formed on a fuel feeding pipe 3 and the differential pressure of the pressure of downstream supply pipe 3b and ****** becomes small from predetermined differential pressure Since fuel return tubing like the fuel-pressure regulator valve 5

of the above-mentioned conventional overflow control form becomes completely unnecessary, though it is a return loess method, the fuel-pressure regulator valve 4 can be arranged near the fuel injection valve 9, and reference ******** 6 can be shortened. That is, since about nine-fuel injection valve pressure fluctuation can be made small since the distance of the fuel-pressure regulator valve 4 and a fuel injection valve 9 becomes short, and reference ******** 6 becomes short, the responsibility to change of an engine operation condition can be raised. Moreover, even when the fuel-pressure regulator valve 4 is an inflow control form fuel-pressure regulator valve which makes the fuel of upstream supply pipe 3a flow into downstream supply pipe 3b when the pressure of downstream supply pipe 3b becomes small and the fuel of downstream supply pipe 3b becomes an elevated temperature by the preheating after engine operation termination, the fuel-pressure regulator valve 4 opens and is not open for free passage, and maintains downstream supply pipe 3b to high pressure. And at this time, by preparing further check-valve 2B which permits only the flow from pump 2A to fuel-feeding-pipe 3 direction in pumping plant 2, the back flow to the direction of pump 2A is prevented by check-valve 2B, and upstream supply pipe 3a is also maintained by high pressure. Therefore, since a fuel-pressure regulator valve opens easily like before and the inside of a fuel feeding pipe does not serve as low voltage, generating of the air bubbles by the temperature rise is controlled. Therefore, the fuel supply system excellent in engine restart nature can be offered. Moreover, since the pressure of downstream supply pipe 3b of a fuel feeding pipe 3 is uniquely determined that only predetermined differential pressure will become large from ******, a pressure is not changed like before which repeats a drive and a halt of a pump with a fuel control system, and controls fuel pressure in the fixed range, and it can perform highly precise and stable fuel pressure control. Moreover, since the fuel circulating load to tank 2C becomes only what was relieved by relief-valve 2C and a circulating load reduces it by being an inflow control form fuel-pressure regulator valve, the rise of the fuel temperature in a tank 1 can be prevented.

[0035] Drawing 4 explains the 2nd example of this invention. This example is also an example about a fuel supply system as well as the 1st example. The conceptual diagram showing the whole fuel supply system 200 configuration by this example is shown in drawing 4 . The same sign is given to a member equivalent to the 1st example. The main points that the fuel supply system 200 of this example differs from the fuel supply system 100 of the 1st example in drawing 4 are having, a pressure detection means 10, for example, a pressure sensor, changing and outputting the pressure of upstream supply pipe 3a of a fuel feeding pipe 3 to the detecting signal which detects and corresponds, and a pump-control means 11, for example, an electronic control, controlling the pump drive motor which the detecting signal from this pressure sensor 10 responds for inputting, and is not illustrated through an output line 13. In the control software which is not illustrated in an electronic control 11 here The 3rd predetermined value in the larger range smaller than the 1st predetermined value mentioned above in the 1st example and than the 2nd predetermined value is set up beforehand. The signal from a pressure sensor 10 It is inputted into the control software through the analog-to-digital-conversion equipment which is not illustrated in an electronic control 11. It is compared with the 3rd predetermined value in this control software, and the driving signal which drives a pump 2 so that the pressure of upstream supply pipe 3a may serve as this 3rd predetermined value is outputted through an output line 13. In addition, this electronic control 11 can also be used also [electronic control / which gives the valve-opening time amount signal which is not illustrated to a fuel injection valve 9, and determines the fuel amount of supply to an engine uniquely]. The 3rd above-mentioned predetermined value can be selected to a fluctuation possible value etc. in the range which made the one set point which considers as the one set point set as arbitration, or is defined according to an engine's operational status, or was described above. This 3rd predetermined value is not necessarily the need always, and only when a pump operates by the above capacity to some extent so to speak, it is required. That is, if it is more than the pressure that downstream supply pipe 3b needs, the function of a fuel supply system will be materialized theoretically. In addition, in setting nothing up as this 3rd predetermined value, the pressure of downstream supply pipe 3b turns into relief pressure force of pumping plant 2 automatically.

[0036] In the fuel supply system 200 of the above-mentioned configuration, it has the pressure sensor 10 which outputs the detecting signal which detects the pressure of upstream supply pipe 3a of a fuel

feeding pipe 3, and corresponds, and the electronic control 11 which controls the drive of pump 2A to become the 3rd predetermined value which has the pressure of upstream supply pipe 3a in the larger range smaller than the 1st predetermined value and than the 2nd predetermined value according to a detecting signal. Since the pressure of upstream supply pipe 3a is maintained at the 3rd predetermined value by the 2nd predetermined value which mentioned above the pressure of downstream supply pipe 3b at this time, according to the size of a need fuel flow to a fuel injection valve 9, the drive of pump 2A will be automatically controlled by the electronic control 11 by it. Namely, although a lot of fuel flow is needed for a fuel injection valve 9 at the time of high-speed operation, the fuel of downstream supply pipe 3b is quickly supplied to a fuel injection valve 9 and the pressure of downstream supply pipe 3b tends to fall quickly Although a fuel is supplied to downstream supply pipe 3b from upstream supply pipe 3a by ******, and the pressure of downstream supply pipe 3b is maintained by the 2nd predetermined value and the pressure of upstream supply pipe 3a tends to fall quickly by this, that of the fuel-pressure regulator valve 5 Pump 2A is controlled according to the rapid fall, it drives by high rotation, the pressure drop of upstream supply pipe 3a is prevented, and it maintains to the 3rd predetermined value. On the contrary, since a fuel flow required for a fuel injection valve 9 is little at the time of low r.p.m. operation, it is sufficient for it, and the fuel of downstream supply pipe 3b is seldom supplied to a fuel injection valve 9 but the pressure of downstream supply pipe 3b seldom falls, a fuel is seldom supplied to downstream supply pipe 3b from upstream supply pipe 3a, but the pressure of upstream supply pipe 3a tends to fall slowly. Therefore, pump 2A will be controlled according to this slow fall, and it will drive by low rotation. Thus, highly precise feedback control according to a need fuel flow and a pressure can be performed easily. That is, the differential pressure for flowing into larger part downstream supply pipe 3b than the 2nd predetermined value is securable by making the 3rd predetermined value at this time larger than the 2nd predetermined value. Moreover, if the 3rd predetermined value is made larger than the 1st predetermined value, since it is held at the predetermined value of a basis 1st that the pressure of a fuel feeding pipe 3 is also for relief-valve 2C, no matter what drive pump 2A may carry out, it does not result in the 3rd predetermined value and cannot control. Moreover, whenever it makes it equal to the 1st predetermined value, the 3rd predetermined value will be reached, and there is no semantics to control. However, in this example, by setting up the 3rd predetermined value smaller than the 1st predetermined value, the above-mentioned control can be performed effectively and reduction of a part with the 3rd predetermined value smaller than the 1st predetermined value, a pump flow rate loss, and pump consumption power can be aimed at.

[0037] In addition, in the above-mentioned configuration, although both a pressure sensor 10 and an electronic control 11, and relief-valve 2C (refer to drawing 1) with which pumping plant 2 was equipped were prepared, relief-valve 2C can also be omitted and a pressure sensor 10 and an electronic control 11 will constitute a discharge-pressure maintenance means in this case. Moreover, the configuration which controls a driving signal so that a pressure value may not be changed into a continuous electrical signal, switching operation may be carried out with a specific pressure value and this switch signal is intermittent with a predetermined time interval is sufficient as a pressure sensor 10. The same effectiveness is acquired also in this case. furthermore, the driving signal to which the driving signal from an output line 13 is a known approach, for example, the current value was changed continuously and the driving signal which is simply intermittent in a pump -- or it is also possible to select to the driving signal with which the real drive current value was controlled by duty change. The same effectiveness is acquired also in this case.

[0038] Drawing 5 and drawing 6 explain the 3rd example of this invention. This example is an example of the fuel-pressure regulator valve used in the fuel supply system 100,200 of the 1st and 2nd examples. The same sign is given to a member equivalent to the 1st and 2nd examples. Drawing of longitudinal section showing the configuration of the fuel-pressure regulator valve 4 of this example is shown in drawing 5 . The fuel-pressure regulator valve 4 is connected to reference ******** 6 which draws the reference pressure near the injection section of the fuel injection valve 9 which injects a fuel within [of the engine which is not illustrated] inhalation of air in drawing 5 . The casing 42 which adjusts the fuel pressure in the fuel feeding pipe 3 (refer to drawing 1 and drawing 4 above) which leads a fuel to a fuel

injection valve 9, and consists of casing-upper-half 42U and casing-lower-half 42L, The diaphram 36 classified into the pressure regulation room 52 which is arranged in the casing 42 interior at the ****** room 51 and illustration lower part which are arranged in the illustration upper part, and adjusts the pressure of a supply fuel, Reference pressure-welding **** 44 to which it is airtightly fixed to casing-upper-half 42U, and reference ******** 6 is connected, The pressure regulation fuel delivery 46 where it is fixed to an oiltight by casing-lower-half 42L, and downstream supply pipe 3b (refer to drawing 1 and drawing 4) of a fuel feeding pipe 3 is connected to it, The supply fuel end connection 22 to which it is fixed to casing-lower-half 42L, and upstream supply pipe 3a of a fuel feeding pipe 3 is connected, At least one side hole 23 which opens for free passage the periphery slot 24 which was formed in this supply fuel end connection 22, and was formed in the longitudinal hole 25 and periphery of the supply fuel end-connection 22 interior, It is arranged in the pressure regulation room 52, and deformation (after-mentioned) of diaphram 36 is embraced. The movable bulb 26 movable in the deformation direction (the illustration vertical direction) of diaphram 36, The bulb holder 34 which transmits deformation migration of diaphram 36 to the movable bulb 26 while holding the movable bulb 26, It has the side hole 30 formed in the movable bulb 26, and the main spring 41 to which it is arranged in the ****** room 51 and an end energizes diaphram 36 toward a pressure regulation fuel delivery side (illustration down) in contact with diaphram 36.

[0039] diaphram 36 -- ****** of the bulb holder 34 -- in a center section, it is mostly put between spring retainers 37, is held by closing the step 38 of the bulb holder 34, and is deformable as a pressure receiving member according to the size of the pressure in the ****** room 51, and the pressure in the pressure regulation room 52. Moreover, the diaphram guide 40 to which it shows deformation migration in the upper part of diaphram 36 is formed in the upper part of diaphram 36, and this diaphram guide 40, diaphram 36, and the upper limit section of casing-lower-half 42L are being fixed by closing the lower limit section of casing-upper-half 42U. The upper part of the bulb holder 34 is extended as the stopper section 39, and can restrict migration in too much upper part of the bulb holder 34 and the movable bulb 26 in contact with casing-upper-half 42U as occasion demands. The main spring 41 is pinched between casing-upper-half 42U and a spring retainer 37, the energization force is equal to the 1st predetermined differential pressure, and the energization force is finely tuned by making the shoulder 43 of casing-upper-half 42U deform suitably.

[0040] The movable bulb 26 can give the energization force from the illustration upper part with the subsp. ring 47 which was held by the caulking section 35 of the bulb holder 34 at the bulb edge 33 of neck 31 upper limit of a minor diameter and by which endocyst is carried out to the bulb holder 34 while pressing down, inserting in a plate 32 and being contacted from an illustration lower part with the presser-foot plate of a bulb edge 33 smell lever, and is held by these having two incomes at shaft orientations (the illustration vertical direction). This presser-foot plate 32 has the bore section with a notch, as shown in drawing 6 , and the magnitude of this bore is larger than the neck 31 of the movable bulb 26. Movement of the illustration longitudinal direction of the bulb edge 33 and the depth direction becomes free by this, and alignment nature is given between the fuel-supply end connection 22 and the movable bulb 26. Moreover, the movable bulb 26 equips the upper limit section of a bore part with the bore limb 27, and the lower limit section of this bore limb 27 forms the bulb edge section 29. And while the pressure regulation slot 48 and at least one side hole 49 are formed in a downward bore part at the pan of this bulb edge section 29, it has fitted in with the periphery of the supply fuel end connection 22, and the movable bulb 26 can slide on the shaft orientations (the illustration vertical direction) of the supply fuel end connection 22 according to deformation of diaphram 36.

[0041] The actuation and the operation in the above-mentioned configuration are explained.

[0042] The fuel-pressure adjustment actuation in the fuel-pressure regulator valve 4 of this example is made by the balance of the force which mainly acts on diaphram 36 from the upper and lower sides. That is, while the reference pressure, i.e., the pressure of the injection section of a fuel injection valve 9 (refer to drawing 1 and drawing 4) and the energization force of a main spring 41, led to the ****** room 51 acts to an illustration lower part to diaphram 36, the pressure in the pressure regulation room 52 acts on the illustration upper part to diaphram 36.

[0043] If the pressure in downstream supply pipe 3b of a fuel feeding pipe 3 becomes small here and the differential pressure of the pressure in the equal pressure regulation room 52 and the pressure in the ****** room 6 becomes small substantially with this pressure, diaphram 36 will deform into the pressure regulation room 52 side (illustration lower part), and the movable bulb 26 will move to the pressure regulation room 52 side (illustration lower part) according to this. And if the differential pressure of the pressure in the pressure regulation room 52 and the pressure in the ****** room 6 becomes small and becomes small further from the 1st predetermined differential pressure equal to the energization force of a main spring 41 (i.e., if the resultant force with the pressure in the ****** room 51 and the energization force of a main spring 41 becomes larger than the pressure in the pressure regulation room 52), the side hole 23 and the pressure regulation room 52 of the supply fuel end connection 22 will be open for free passage through the side hole 30 of the movable bulb 26. Therefore, the fuel which was sent out from pumping plant 2 and supplied from upstream supply pipe 3a of a fuel feeding pipe 3 flows into downstream supply pipe 3b from the dugout 25 of the supply fuel end connection 22 through a side hole 23, the periphery slot 24, the bore limb 27 of the movable bulb 26 and a side hole 30, the pressure regulation room 52, and the pressure regulation fuel delivery 46. In addition, in order to regulate migration in too much lower part of the movable bulb 26, it can also constitute so that the upper limit section 28 of the bore limb 27 of the movable bulb 26 may be made to contact the external upper limit section of the supply fuel end connection 22. If a fuel flows as mentioned above and the pressure of the pressure regulation room 52 rises, diaphram 36 and the bulb holder 34, and the movable bulb 26 move up. And if the differential pressure of the pressure in the pressure regulation room 52 and the pressure in the ****** room 51 becomes larger than the 1st predetermined differential pressure equal to the energization force of a main spring 41 Namely, if it becomes larger than resultant force with the pressure in the ****** room 51 which the upward force of acting on diaphram 36 from the pressure regulation room 52 mentioned above, and the energization force of a main spring 41 The bulb edge section 29 of the movable bulb 26 blockades the periphery slot 24 of the supply fuel end connection 22, and the fuel from a longitudinal hole 25 stops flowing into the pressure regulation room 52.

[0044] By actuation explained above, from ******, the pressure of downstream supply pipe 3b is always held so that only predetermined differential pressure may become large. That is, since the differential pressure of the fuel pressure led to a fuel injection valve 9 (refer to drawing 1 and drawing 4) and the pressure in the injection section of the fuel injection valve 9 which is ****** becomes fixed irrespective of engine operational status, the fuel amount-of-supply control of it with a high precision is attained. moreover , since the active area to which the pressure in the pressure regulation room 52 act on diaphram 36 at illustration facing up do not change even if the control path for fuel-pressure adjustment be form in the cylinder periphery section of the supply fuel end connection 22 , and the cylinder inner circumference section of the movable bulb 26 , this control path be open for free passage through a side hole 23 or a side hole 30 and it close at this time , the small pressure regulation function of pressure fluctuation that precision be high and can be obtain .

[0045] Moreover, if an engine stops and the fuel temperature of the parts of downstream supply pipe 3b of a fuel feeding pipe 3 or a fuel injection valve 9 rises, the volume of a fuel will expand, the pressure of this part will rise, and the pressure of the pressure regulation room 52 will also rise. By arranging downward lock out **** sufficiently caudad from the bulb edge section 29 in the movable valve 26, although diaphram 36, the bulb holder 34, and the movable valve 26 will also move up according to this, even if the movable valve 26 moves upwards, it supposes that the bore section has blockaded the periphery slot 24, and things can be carried out. Since this cannot be wide opened even if the fuel pressure of the lower stream of a river which includes the pressure regulation room 52 by this rises, but fuel pressure is held in the sufficiently high-pressure state, it is possible for generating of fuel air bubbles to be controlled and to prevent aggravation of engine restart nature. Furthermore, in order to ensure the high-pressure condition of this fuel, a dimension can be determined that it makes the stopper section 39 of the bulb holder 34 contact casing-upper-half 42U at the time of upper part migration of such a movable valve 26, the bulb holder 34, and diaphram 36, and migration in the upper part of the

movable valve 26 can also be regulated by this.
[0046] However, the effect of the pressure buildup by the cubical expansion resulting from the fuel temperature rise at this time is farther [than the pressure relaxation effect by that bulk modulus] large, when not carrying out a volume change at all, it serves as a big pressure buildup too much, and un-arranging [which will require too much pressure resistance] produces it on the use components containing a piping network. In here, too much rise of a pressure can be first eased by taking the large path of diaphram 36 suitably by the fuel-pressure regulator valve 4 of this example in permuting primary cubical expansion [in /-like / the downstream after the pressure regulation room 52] by deformation migration of diaphram 36. And although diaphram 36 and the movable bulb 26 will move up if a pressure still continues rising If the differential pressure of the pressure in the pressure regulation room 52 and the pressure in the ****** room 51 becomes larger than the predetermined differential pressure set as a certain larger value than predetermined differential pressure The pressure regulation slot 48 and side hole 49 which were prepared in the movable bulb 26 carry out opening to the side hole 23 and the pressure regulation slot 24 which were established in the supply (for example, before the stopper section 39 contacts casing-upper half 43) fuel end connection 22, and open these side holes 23 and the pressure regulation slot 24, and the pressure regulation room 52 for free passage. Thereby, since the fuel of the downstream after the pressure regulation room 52 flows into upstream supply pipe 3a of a fuel feeding pipe 3 through a side hole 49, the pressure regulation slot 48, the periphery slot 24, and a longitudinal hole 25, the volume which connotes a fuel becomes large and it can prevent an overpressure rise. Therefore, the safety of the fuel-pressure regulator valve 4 and a fuel supply system 100,200 (refer to drawing 1 and drawing 4) can be improved.
[0047] In addition, in the above, although considered as the structure which misses a high-pressure fuel to the upstream through the side hole 49 and the pressure regulation slot 48 which were established in the lower part of the movable bulb 26, it is not restricted to this but a downward part may be omitted from the location of a side hole 49 and the pressure regulation slot 48 in the cross-section structure of the illustration movable bulb 26. If it is made this structure and the differential pressure of the pressure in the pressure regulation room 52 and the pressure in the ****** room 51 will become smaller than the 2nd predetermined differential pressure The lower limit (it will exist in illustration side hole 49 location mostly in this case) of the movable bulb 26 It will move more nearly up than the side hole 23 and the pressure regulation slot 24 of the supply fuel end connection 22, namely, the periphery of a side hole 23 and the pressure regulation slot 24 will deviate from the inner circumference of the movable bulb 26, and it will be opened wide at the direct pressure regulation room 52. The same effectiveness is acquired also by this.
[0048]
[Effect of the Invention] Since according to this invention a fuel-pressure regulator valve is an inflow control form fuel-pressure regulator valve which the fuel of an upstream part is made to flow into a downstream part, and holds a downstream pressure to the 2nd predetermined value when it is prepared on a fuel feeding pipe and the pressure of a downstream part becomes smaller than the 2nd predetermined value, fuel return tubing like the conventional overflow control form fuel-pressure regulator valve becomes completely unnecessary. Therefore, though it is a return loess method, a fuel-pressure regulator valve can be arranged near the fuel injection valve, and reference ******** can be shortened. That is, since pressure fluctuation near the fuel injection valve can be made small since the distance of a fuel-pressure regulator valve and a fuel injection valve becomes short, and reference ******** becomes short, the responsibility to change of an engine operation condition can also be raised. Moreover, since a fuel-pressure regulator valve is not open for free passage and the downstream is maintained to high pressure even when the fuel of the downstream becomes an elevated temperature by remaining heat after engine operation termination, generating of the air bubbles by the temperature rise is controlled, and the fuel supply system excellent in engine restart nature can be offered. Furthermore, since the pressure of the downstream part of a fuel-pressure regulator valve is uniquely determined as the 2nd predetermined value, highly precise and stable fuel pressure control can be performed. Moreover, the fuel circulating load to a tank can be reduced and the rise of the charge

temperature of fuel tank internal combustion can be reduced. Moreover, the fuel supply system which the back flow to the direction of a fuel pump was prevented, the upstream also became high pressure at the time of the fuel elevated temperature after engine operation termination, and generating of the air bubbles by the temperature rise was controlled by it, and was excellent in it at engine restart nature since the check valve which permits only the flow from a fuel pump to the direction of a fuel feeding pipe was further prepared in fuel pump equipment can be offered. Furthermore, from ******, if the differential pressure of the pressure of the pressure regulation interior of a room and the pressure of reference ****** becomes small and this value becomes small from predetermined differential pressure, since the 1st hole and pressure regulation room of a supply fuel end connection will be open for free passage through the 2nd hole of a movable bulb, the pressure of a downstream part can be held so that only predetermined differential pressure may become large. Moreover, since the active area of the force of acting on diaphram from a pressure regulation room side does not change even if the 1st hole and pressure regulation room are open for free passage and it does not carry out, the small pressure regulation function of pressure fluctuation that precision is high and can be obtained. Furthermore, a pressure detection means to output the detecting signal which detects the pressure of an upstream part and corresponds from a fuel-pressure regulator valve among fuel feeding pipes, Since it has a pump-control means to control the drive of a fuel pump so that it may become the 3rd predetermined value which has the pressure of an upstream part in the larger range smaller than the 1st predetermined value and than the 2nd predetermined value according to a detecting signal Highly precise feedback control according to a need fuel flow and a pressure can be performed easily, and reduction of a pump flow rate loss and pump consumption power can be aimed at.

[0049] Moreover, since according to this invention it has the opening part which opens the 1st hole and pressure regulation room for free passage when a movable bulb becomes larger than the 2nd predetermined differential pressure with the bigger differential pressure of the pressure of the pressure regulation interior of a room, and the pressure of reference ****** than the 1st predetermined differential pressure If a fuel temperature rises by the preheating after engine operation termination and the pressure of the downstream becomes the 2nd predetermined differential pressure, a pressure regulation room and an upper part are open for free passage through the 1st hole and opening part, and the fuel of the downstream can flow into the upstream and can prevent the overpressure rise of the pressure regulation interior of a room. Therefore, the safety of a fuel-pressure regulator valve and a fuel supply system can be improved.

[Translation done.]